2010–2011 Minerals Yearbook

WYOMING [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

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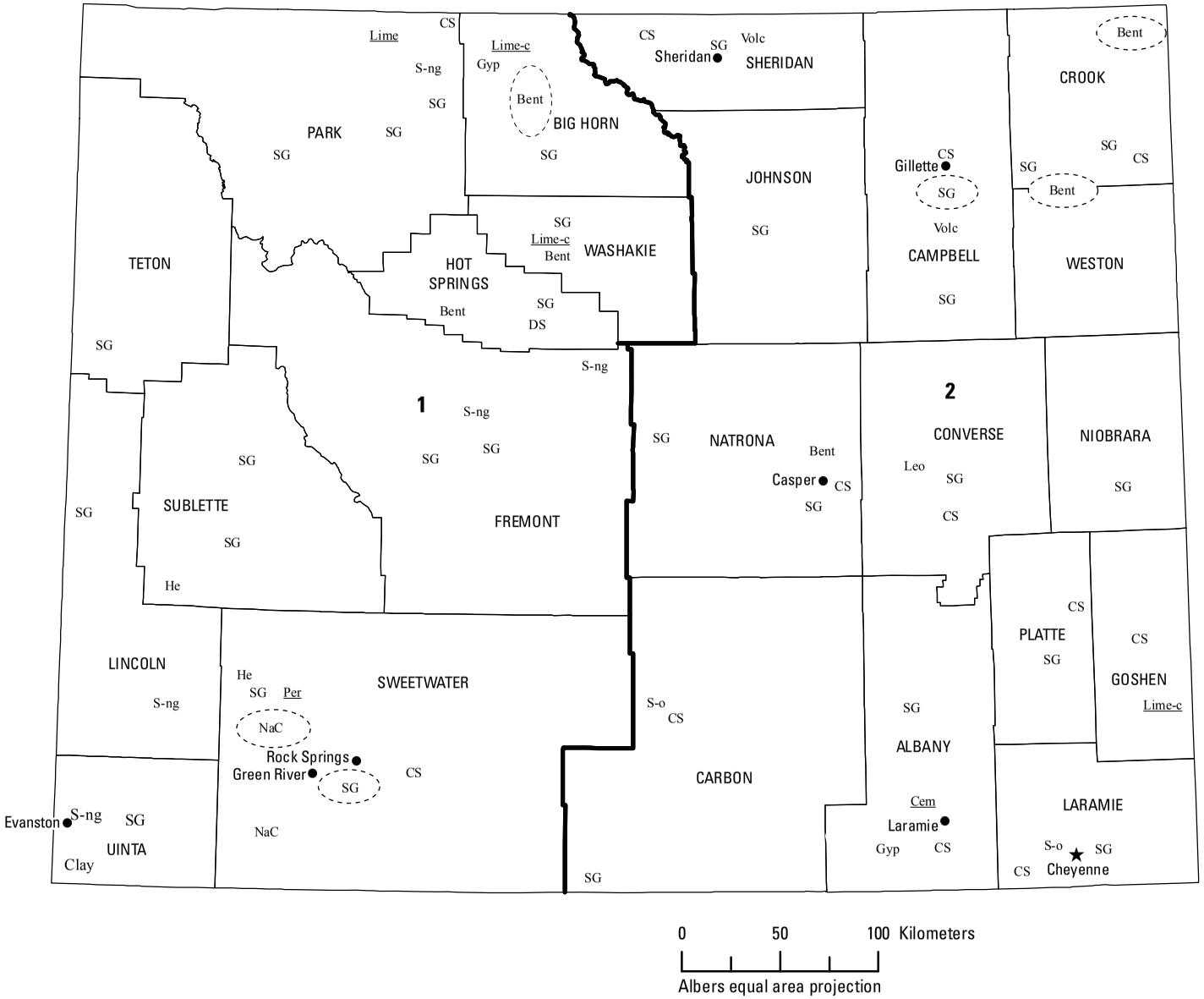
WYOMING



LEGEND

County boundary
Capital
City
1 Crushed stone/sand and gravel district boundary

MINERAL SYMBOLS
(Principal producing areas)

Bent	Bentonite
Cem	Cement plant
Clay	Common clay
CS	Crushed stone
DS	Dimension stone
Gyp	Gypsum
He	Helium
Leo	Leonardite
Lime	Lime plant
Lime-c	Lime plant (captive)
NaC	Sodium carbonate
Per	Perlite plant
SG	Construction sand and gravel
S-ng	Sulfur (natural gas)
S-o	Sulfur (oil)
Volc	Volcanic cinder

Concentration of mineral operations

Source: Wyoming State Geological Survey/U.S. Geological Survey (2010–11).

The Mineral Industry of Wyoming

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Wyoming State Geological Survey for collecting information on all nonfuel minerals.

In 2011, Wyoming's nonfuel mineral production[1] was valued at $2.14 billion, based upon annual U.S. Geological Survey (USGS) data. This was an almost $275 million (15%) increase from the State's total nonfuel mineral production value of $1.87 billion in 2010, which followed a $68 million (4%) increase from $1.8 billion in 2009. Even though the State's total production value increased through 2011, surpassing the previous record in 2008, the State fell in rank from 10th to 11th among the 50 States in total nonfuel mineral production value. In 2011, Wyoming accounted for 2.9% of the U.S. total production value. For the sixth consecutive year, the State ranked second in the Nation for the per capita production value of its nonfuel mineral industry. The production value per capita increased to $3,770, more than 15 times the national average of $240.

In 2011, soda ash remained Wyoming's leading nonfuel mineral by production value. Bentonite clay, Grade-A helium, construction sand and gravel, portland cement, and crushed stone followed. Together, these six mineral commodities have accounted for approximately 99% of the State's total nonfuel raw mineral production value since 2005.

Of the 10 mineral commodities produced in Wyoming in 2011, all but 2 increased in production value and all but 4 increased in production quantity (table 1). Dimension stone production was not reported in 2011. Of the mineral commodities having production values that could be individually published, bentonite clays had the largest increase, up by more than $57 million (25%) though production quantity had increased by less than 6%. Construction sand and gravel followed, up $18.8 million (26%), despite a 1.6-million-metric-ton (Mt) decline in production quantity. The production value of crushed stone increased by $9.2 million (22%), proportional to an increase in production quantity of 24%. Soda ash and crude gypsum also increased in production quantity and value (data withheld—company proprietary data). Lime and Grade-A helium were the only mineral commodities to decrease in production quantity and value (data withheld—company proprietary data). However, the combined total value of all mineral commodities having concealed production values increased by 12%, led by a significant increase in soda ash production value.

In 2010, 5 of the 11 mineral commodities produced in Wyoming increased in production value. Bentonite had the largest increase, up by $57.2 million (33%), associated with a 28% production quantity increase. The other four, in descending order of production value increase, were helium, soda ash, portland cement, and lime (values withheld—company proprietary data). Crushed stone had the largest decrease in production value, by $35 million (46%), and in production quantity, declining by 7.3 Mt to 9.2 Mt (44%), from a 10-year production maximum of 16.5 Mt in 2009. Construction sand and gravel followed, decreasing by $20.3 million (22%), and by 2.8 Mt (16%). Common clays decreased significantly in production value and production quantity, by $71,000 (68%), and by 29,000 metric tons (71%), which is comparable to the increases in 2011.

Since at least 1986,[2] Wyoming continued to be ranked first in soda ash and bentonite clay production, and since at least 1987, second in Grade-A helium production. Since 2005, Wyoming has been one of only two soda ash-producing States, with California producing a significantly smaller amount. Sweetwater County hosts the world's largest known deposit of trona, the major source for soda ash production. The State fell in rank from 17th to 20th in the production of construction sand and gravel.

The Wyoming State Geological Survey[3] (WSGS) provided the basis for the following narrative. Production data in the text that follows are reported by the WSGS and are based on the agency's own surveys and estimates. They may differ from production figures reported to the USGS.

Exploration and Development Activities

Overall, metals exploration in Wyoming continued at a relatively low level. Prices for copper and platinum-group elements recovered substantially after their 2008 decline, resulting in minor interest across the State, but failed to stimulate any significant exploration efforts during 2010. However, major companies and individual prospectors increased some exploration activities for gold and rare-earth elements (REE). The WSGS also collected samples for REE analysis in 2010 and 2011, ahead of a study on REE in Wyoming.

[1]The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All USGS mineral production data published in this chapter are those available as of May 2013. Data in this report are rounded to three significant digits and percentages are calculated from unrounded data. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at http://minerals.usgs.gov/minerals.

[2]The U.S. Bureau of Mines began to publish detailed commodity rankings among States in the 1986 edition of the Minerals Yearbook.

[3]Wayne M. Sutherland, Geologist (gemstones, metals, and economic geology specialist), and Robert Gregory, Geologist (uranium and minerals specialist) of the Wyoming State Geological Survey, coauthored the text of the State mineral industry information.

Industrial Minerals

Stone, Crushed.—A high-purity-limestone quarry 16 kilometers (km) north of Laramie, originally planned for construction to begin in 2009, was still in the planning stages. The limestone is part of the Casper Formation, which crops out extensively along the western flank of the Laramie Mountains. The lime plant, which would be operated by Pete Lien & Sons Inc. (Rapid City, SD), was to employ about 50 workers. In 2011, the Bureau of Land Management issued a finding of no significant impact after an environmental assessment was completed on the mine (Bureau of Land Management, 2011).

Metals

Gold.—Average gold prices increased to $1,228 per troy ounce in 2010 and $1,572 in 2011 (George, 2012; 2013), bringing renewed incentive for exploration. Evolving Gold Corp. (Vancouver, British Columbia, Canada) completed a total of 63 core holes in 2010 for a total of approximately 26 km of drilling. The drilling program intersected long intervals of gold mineralization, demonstrated continuity of mineralization at the North Stock gold zone, and improved definition of the Antelope Basin target of the Rattlesnake Hills Project in Natrona County (Evolving Gold Corp., 2010, 2011). Notable intercepts included one hole that intersected 332 meters (m) of gold-bearing rock at a grade of 1.28 grams per metric ton (g/t) gold, including 42.7 m at 3.91 g/t and 16.8 m at 7.26 g/t (Evolving Gold Corp., 2010). Another drill hole intersected 313 m of gold mineralization at a grade of 1.94 g/t gold, including 21.3 m at 10.0 g/t (Evolving Gold Corp., 2011). The company continued core drilling in 2011, completing 8,193 m in 24 holes. A new gold zone was identified at the South Stock target, south of Antelope Hills, with an intersect of 3.1 m at 9.30 g/t gold (Evolving Gold Corp., 2012).

Rare Element Resources completed gold exploration drilling in the Bear Lodge Mountains with positive results. Thirty-four rotary drill holes totaling nearly 6,600 m were drilled during 2010 at the Smith, Carbon, and Taylor target areas on the Sundance gold project. Gold exploration during 2010 focused on three factors: (1) in-fill drilling for detailed definition of known gold-mineralized targets, (2) step-out drilling from known mineralization, and (3) discovery of gold mineralization in a new peripheral target (Rare Element Resources Ltd., 2011a). In 2011, 6,989 m were drilled in 36 holes. The most notable contained 176.8 m at 1.21 g/t gold, including 24.4 m at 4.5 g/t gold (Rare Element Resources Ltd., 2012).

Rare Earths.—Rare Element Resources announced that a preliminary economic assessment on their delineated REE resources in the Bear Lodge project demonstrated acceptable economic returns, and concluded that the project should advance to a prefeasibility analysis (Rare Element Resources Ltd., 2010a). The company then completed a bulk sampling program to feed a proposed pilot plant designed to test the commercial viability of a mineral process flowsheet. The pilot plant test was planned to be part of a preliminary feasibility study (Rare Element Resources Ltd., 2010b). Two pilot plant metallurgical campaigns were completed in 2011 to test an economical ore-processing method. Several hundred kilograms of rare-earth carbonate concentrate was produced through the pilot plant testing process (Rare Element Resources Ltd., 2011b).

Commodity Review

The WSGS relies on the State Inspector of Mines of Wyoming for mineral production and employment numbers. These often differ from those of the USGS due to differences in methods of calculation and commodity-related terminology. For example, materials reported by the State Inspector of Mines of Wyoming as aggregates may include crushed granite, crushed limestone, sand and gravel, and scoria. Numbers reported for limestone may include material used for crushed stone in road base applications, as well as material used in the manufacture of cement and other applications requiring high-purity limestone. In previous reports, attempts were made to clarify both sources and end uses of materials for categorization in concert with USGS terminology. However, for 2010 and 2011, figures are based directly on reports from the State Inspector of Mines, which may lead to some conflict with data from preceding years.

Industrial Minerals

Bentonite.—According to figures in the annual report of the State Inspector of Mines of Wyoming, mine production of bentonite increased by 63% in 2010 from 2009, and 23% in 2011 from 2010. Plant production increased by 23% in 2010, although it decreased 21% in 2011. The number of employees working in the bentonite industry increased slightly more than 10% in 2010 and in 2011 (Adcock, 2009; 2010; 2011). With an estimated 19% of bentonite produced used for drilling mud nationwide (Virta, 2011), the upswing in production was likely owing to increases in domestic oil and gas exploration.

Cement.—Mountain Cement in Laramie began investigating local volcanic ash deposits for sources of pozzolan cement additive. They also reported purchasing magnetite iron ore from deposits in the Laramie Mountains for use as an additive to supply iron in the clinker. Another company investigated high-alumina shale and other materials in the vicinity of the Wind River Indian Reservation for possible use in cement production.

Gemstones.—Wyoming gemstone activity continued to be dominated by amateur collectors. Amateur interest across the State covered a wide variety of precious and semiprecious gemstones, including chalcedony and agate, corundum, nephrite jade, and diverse rock types of both lapidary and academic interest.

Following the economic downturn of 2008, commercial gemstone activity in Wyoming remained weak through 2010. Although no significant gemstone production took place within the State, representatives from China expressed interest in obtaining Wyoming jade in any quantities available. Individual prospectors continued searching for kimberlite and diamonds, but no companies pursued larger organized sampling or other exploration activities.

Gypsum.—Wyoming gypsum production increased almost 20% in 2010 over that reported in 2009, and decreased by slightly more than 2% in 2011 from 2010. Gypsum is primarily

used in the production of wallboard, building plasters, and portland cement, in decreasing order of amount.

Soda Ash.—Wyoming's four producers mined nearly 15 Mt of trona in 2010 compared to 13.2 Mt tons in 2009, an increase of 13%. In 2011, mine production increased 3% to about 15.4 Mt (Adcock, 2009; 2010; 2011). Production in 2009 was adversely affected by the global economic downturn in the latter part of 2008. At a trona-to-soda-ash ratio of approximately 3:2, the 2010 and 2011 production translates to roughly 10.0 Mt and 10.3 Mt of soda ash, respectively, shipped from Wyoming. The average sales price for a metric ton of soda ash in 2010 was $125.64, down 10 % from 2009, and in 2011, it was $147.34, up 17% (Kostick, 2013).

Zeolites.—The zeolite quarry (sodium-rich clinoptilolite) southeast of Rock Springs remained inactive during 2010 and 2011.

Government Activities

During 2010 and 2011, the WSGS continued its activity in the STATEMAP program. STATEMAP is a component of the congressionally mandated National Cooperative Geologic Mapping Program through which the USGS distributes Federal funds to support geologic mapping efforts through a competitive funding process. During 2010, the WSGS, in cooperation with the STATEMAP program, published six maps: geologic maps of the Lusk and Rock Springs 30-minute x 60-minute quadrangles, preliminary geologic maps of the Baggs and Baroil 30-minute x 60-minute quadrangles, preliminary geologic map of the Sherman Mountains West 7.5-minute quadrangle, and the surficial geologic map of the Pinedale 30-minute x 60-minute quadrangle.

The WSGS Web site (http://www.wsgs.uwyo.edu/) is the source for information on Wyoming's minerals and geology. Printed publications and geologic maps, along with various digital products, can now be ordered directly online.

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TABLE 1
NONFUEL RAW MINERAL PRODUCTION IN WYOMING[1, 2]

(Thousand metric tons and thousand dollars)

Mineral	2009		2010		2011	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Bentonite	3,230	172,000	4,120	230,000	4,350	287,000
Common	41	104	12	33	20	60
Gemstones, natural	NA	14	NA	14	NA	15
Sand and gravel, construction	17,300 r	92,400 r	14,500	72,200	12,800	91,000
Stone, crushed	16,500 r	76,300 r	9,240	41,400	11,500	50,700
Combined values of cement (portland), gypsum (crude), helium (Grade-A), lime, soda ash, stone [dimension (2009–10)]	XX	1,460,000	XX	1,530,000	XX	1,710,000
Total	XX	1,800,000	XX	1,870,000	XX	2,140,000

[r]Revised. NA Not available. XX Not applicable.
[1]Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2]Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 2
WYOMING: CRUSHED STONE SOLD OR USED IN THE UNITED STATES, BY TYPE[1]

Type	2009				2010				2011			
	Number of quarries	Quantity (thousand metric tons)	Value (thousand)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone[2]	12 r	3,420	$21,800	$6.36	10	2,040	$12,600	$6.18	11	3,370	$19,300	$5.73
Granite	1 r	2,620 r	17,000 r	6.50	1	1,940	12,300	6.34	1	2,150	13,600	6.34
Sandstone and quartzite[3]	--	--	--	--	--	--	--	--	1	414	1,770	4.27
Volcanic cinder and scoria	9	6,880	34,400	5.00	16	1,880	10,100	5.39	12	2,630	13,600	5.16
Miscellaneous stone	3 r	3,090 r	2,240 r	0.73	11	3,380	6,430	1.90	7	2,900	2,390	0.82
Total or average	XX	16,500	76,300	4.71	XX	9,240	41,400	4.48	XX	11,500	50,700	4.42

[r]Revised. XX Not applicable. -- Zero.
[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.
[2]Includes limestone-dolomite reported with no distinction between the two kinds of stone.
[3]Includes sandstone-quartzite reported with no distinction between the two kinds of stone.

TABLE 3
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 2010, BY USE[1]

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate, graded:		
Concrete aggregate, coarse	W	W
Bituminous surface-treatment aggregate	W	W
Coarse and fine aggregates:		
Graded road base or subbase	W	W
Unpaved road surface	W	W
Crusher run or fill or waste	W	W
Other construction materials	2	10
Chemical and metallurgical, cement manufacture	461	2,620
Unspecified:[2]		
Reported	6,380	23,600
Estimated	1,690	10,800
Total	9,240	41,400

W Withheld to avoid disclosing company proprietary data; included in "Total."
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Reported and estimated production without a breakdown by end use.

TABLE 4
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS
IN 2011, BY USE[1]

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse and fine aggregates:		
Graded road base or subbase	W	W
Terrazzo and exposed aggregate	(3)	1
Crusher run or fill or waste	W	W
Chemical and metallurgical, cement manufacture	1,060	3,980
Unspecified:[2]		
Reported	10,300	45,800
Estimated	--	--
Total	11,500	50,700

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
[1]Data are rounded to no more than three significant digits.
[2]Reported and estimated production without a breakdown by end use.
[3]Less than ½ unit.

TABLE 5
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2010, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse aggregate, graded[2]	--	--	W	W	--	--
Coarse and fine aggregates[3]	W	W	W	W	--	--
Other construction materials	--	--	2	10	--	--
Chemical and metallurgical[4]	--	--	461	2,620	--	--
Unspecified:[5]						
Reported	W	W	3,590	20,600	2,790	2,970
Estimated	116	741	1,570	10,000	--	--
Total[6]	266	2,040	5,850	35,300	2,790	2,970

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregates.
[3]Includes graded road base or subbase, unpaved road surface, terrazzo and exposed aggregate, crusher run, roofing granules, and other coarse and fine aggregates.
[4]Includes cement manufacture, lime manufacture, dead-burned dolomite manufacture, flux stone, chemical stone, glass manufacture, and sulfur oxide removal.
[5]Reported and estimated production without a breakdown by end use.
[6]District totals may not add up to the published State total, owing to revisions made after the production of the table and (or) proprietary data being withheld.

TABLE 6
WYOMING: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2011, BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Construction:						
Coarse and fine aggregates[2]	W	W	W	W	--	--
Chemical and metallurgical[3]	W	W	1,060	3,980	--	--
Unspecified:[4]						
Reported	107	688	7,160	42,400	3,060	2,710
Estimated	--	--	--	--	--	--
Total	184	1,540	8,220	46,400	3,060	2,710

W Withheld to avoid disclosing company proprietary data. -- Zero.
[1]Data are rounded to no more than three significant digits.
[2]Includes graded road base or subbase, unpaved road surface, terrazzo and exposed aggregate, crusher run, roofing granules, and other coarse and fine aggregates.
[3]Includes cement manufacture, lime manufacture, dead-burned dolomite manufacture, flux stone, chemical stone, glass manufacture, and sulfur oxide removal.
[4]Reported and estimated production without a breakdown by end use.

TABLE 7
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2010,
BY MAJOR USE CATEGORY[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	751	$6,970	$9.28
Plaster and gunite sands	2	63	31.50
Asphaltic concrete aggregates and other bituminous mixtures	387	3,610	9.33
Road base and coverings[2]	2,560	15,600	6.09
Fill	191	858	4.49
Snow and ice control	33	323	9.79
Other miscellaneous uses[3]	9	71	7.89
Unspecified:[4]			
Reported	7,590	32,100	4.23
Estimated	2,790	11,900	4.27
Total or average	14,500	72,200	4.98

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.
[2]Includes road and other stabilization (lime).
[3]Includes railroad ballast.
[4]Reported and estimated production without a breakdown by end use.

TABLE 8
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2011,
BY MAJOR USE CATEGORY[1]

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate and concrete products[2]	751	$7,960	$10.60
Asphaltic concrete aggregates and other bituminous mixtures	545	5,900	10.83
Road base and coverings	2,420	17,200	7.11
Fill	288	1,430	4.97
Other miscellaneous uses[3]	59	713	12.08
Unspecified:[4]			
Reported	6,160	41,900	6.80
Estimated	2,570	15,900	6.19
Total or average	12,800	91,000	7.11

[1]Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.
[2]Includes plaster and gunite sands.
[3]Includes railroad ballast, and snow and ice control.
[4]Reported and estimated production without a breakdown by end use.

TABLE 9
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2010,
BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)[2]	W	W	W	W	--	--
Asphaltic concrete aggregates and road base materials[3]	1,230	9,290	1,220	7,590	498	2,360
Fill	107	503	24	156	60	199
Other miscellaneous uses[4]	30	304	4	30	9	60
Unspecified:[5]						
Reported	2,170	12,500	1,960	11,200	3,870	12,300
Estimated	1,450	6,620	1,340	6,750	340	1,570
Total[6]	4,990	29,300	4,540	25,700	4,780	16,500

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes plaster and gunite sands.
[3]Includes road and other stabilization (lime).
[4]Includes railroad ballast, and snow and ice control.
[5]Reported and estimated production without a breakdown by end use.
[6]District totals may not add up to the published State total, owing to revisions made after the production of the table and (or) proprietary data being withheld.

TABLE 10
WYOMING: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2011,
BY USE AND DISTRICT[1]

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate (including concrete sand)[2]	W	W	W	W	44	438
Asphaltic concrete aggregates and road base materials	W	W	W	W	384	2,790
Fill	224	1,060	63	372	--	--
Other miscellaneous uses[3]	13	263	46	450	--	--
Unspecified:[4]						
Reported	1,270	12,000	2,190	15,400	2,710	14,500
Estimated	1,010	5,570	1,140	7,910	426	2,380
Total	4,290	35,800	4,950	35,000	3,560	20,100

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
[1]Data are rounded to no more than three significant digits; may not add to totals shown.
[2]Includes plaster and gunite sands.
[3]Includes railroad ballast, and snow and ice control.
[4]Reported and estimated production without a breakdown by end use.